Philips Pinnacle³ Auto-Segmentation with SPICE

Frequently asked questions

Pinnacle³

Q: What is SPICE?

A: SPICE stands for Smart Probabilistic Image Contouring Engine. This set of algorithms, proprietary to Philips, augments deformable registration with probabilistic segmentation to provide high-quality auto-generated contours. Probabilistic segmentations are especially useful in situations when the contrast between neighboring structures is small and it is difficult to identify the edges between them to produce acceptable contours.

For more information see *"Auto-segmentation of normal and target structures in head and neck CT images: A feature-driven model-based approach."* Qazi A, Pekar V, Kim J, et al. *Med Phys.* 2011 Nov; 38(11):6160-70.

Q: How does Auto-Segmentation with SPICE reduce contouring?

A: SPICE offers significantly faster contouring compared to a manually contoured plan because it uses deformable registration and probabilistic segmentation. This enhances contour quality and simultaneous auto-contouring of multiple patients and structures. The majority of tasks run in the background.

Q: How does Auto-Segmentation work?

A: There are several algorithms within Auto-Segmentation that are used depending on the structures being contoured. The general process can be classified into three steps:
1. Initial positioning of all the organs on patient CT images using probabilistic approach that applies contours from the "best-fit expert atlas"
2. Implementation of coarse deformation to match patient anatomy to organ-specific probabilistic atlases
3. Implementation of refined deformation with probabilistic segmentation to obtain the final contours for each organ

Q: How many sessions of Auto-Segmentation can run simultaneously?

A: The system is designed to allow several instances of Auto-Segmentation to be run concurrently at a given access point. However, to avoid adverse performance issues, Pinnacle³ will prevent the user from overloading system resources by limiting the number of concurrent sessions. This limitation may vary based on the hardware platform.

Q: Which patient orientations are supported by Auto-Segmentation?

A: Auto-Segmentation supports the headfirst supine position for all atlases; additionally it supports the headfirst prone position for the male pelvis.

Q: Can user-specific structures be imported into Auto-Segmentation?

A: Auto-Segmentation comes with pre-set structures within the atlases. Each of these structures has undergone rigorous internal testing and clinical validation to verify that they meet the performance criteria. Additional structures cannot be imported.

Q: How quickly can auto-contours be generated?

A: The following times were obtained during factory testing:
- Male pelvis (99 slices): 2 minutes, 48 seconds
- Head and Neck (104 slices): 5 minutes, 22 seconds
- Lung/thorax contours (107 slices): 2 minutes, 51 seconds
- Abdomen (110 slices): 6 minutes, 3 seconds

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Q: Can structures in the atlases be modified?

A: The names and colors of each structure, as well as the atlas names, can be edited. However, to protect the integrity of SPICE, the secure library of factory-set structures cannot be modified.

Q: Can SPICE be accessed remotely?

A: Because SPICE is completely integrated into Pinnacle[3] it is accessible from any onsite or remote Pinnacle[3] access point with no need to import and export contours between systems.

Q: Will Auto-Segmentation run on all hardware platforms and software versions?

A: Auto-Segmentation runs on systems with Solaris 10 operating systems and beyond. These include: 810 and 810X workstations, Blade Center, SmartEnterprise, and Pinnacle[3] Professional. SPARC systems are not supported. Auto-Segmentation will run on Pinnacle[3] 9.4 and beyond. Older versions of Pinnacle[3] are not supported.

Q: Is it necessary to purchase both Auto-Segmentation with SPICE and Model-Based Segmentation (MBS)?

A: Auto-Segmentation and MBS are two separate modules within Pinnacle[3] that are designed to work independently to automate contouring. Some of the auto-contouring features are common to both. They also offer complementary functionality when used together.

Q: What do Auto-Segmentation and MBS have in common?

A: The functionalities common to both Auto-Segmentation and MBS are:
- Knowledge-based atlases generated from multiple patients
- Deformable registration
- Flexible customization tools for 3D editing
- Integrated into Pinnacle[3]

Q: How does Auto-Segmentation with SPICE differ from MBS?

A: Both MBS and Auto-Segmentation with SPICE offer a degree of flexibility to enhance the contouring process.
The differences between them are:
- MBS requires manual positioning of the atlas and more editing of the end-result, but offers a higher degree of flexibility.
- Auto-Segmentation with SPICE is a much more automated process that requires substantially less user intervention and offers consistently repeatable results. However contouring is restricted to CT datasets and it doesn't allow user to modify (and thus impact) the structure library.

Q: Do Auto-Segmentation with SPICE and MBS have the same algorithms?

A: No. MBS models are individual mesh structures that use a single, structure-specific search criterion to find a balance between internal (shape) and external (image feature) energy functions. They require the user to position and scale each model in a reasonable starting position. SPICE algorithms automatically position, adapt, and fine-tune structures using a complex set of image-processing techniques that are tailored to each structure. These techniques use probabilistic models based on a number of expert segmentations.

Please visit www.philips.com/SPICE

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